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~~This~~ The paper discusses the variety of regulations applicable to asbestos in buildings, ranging from the Clean Air Act to the Asbestos Hazard Emergency Response Act. Remedial actions are discussed (removal, enclosure and encapsulation) and the ongoing research related to those areas is briefly described. Operational and interpretational problems with encapsulant use are also discussed.

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ASBESTOS PROBLEM RESOLUTION

The United States Environmental Protection Agency, directed by laws passed by Congress and signed by the President, has been controlling asbestos since the National Emission Standards for Hazardous Air Pollutants (NESHAP) was promulgated in 1973, as authorized by the Clean Air Act of 1970. Key legislation includes the Toxic Substances Control Act (TSCA) and the Asbestos Hazard Emergency Response Act of 1986 (AHERA).

Summary

Congress has taken steps to resolve the asbestos issue by addressing toxic air pollutants in the Clean Air Act and by addressing asbestos in schools under the Asbestos Hazard and Emergency Response Act. The Occupational Safety and Health Administration and the Environmental Protection Agency have issued rules to minimize asbestos exposure and have published suggested guidance for dealing with asbestos abatement and operation and maintenance (O&M) activities for asbestos to be left in-place.

Research activities within EPA, in combination with private sector experience, are progressing to refine the approaches to the problem of asbestos abatement. Areas where research is improving guidance include:

1) Monitoring methodology
2) Limitations and uses of encapsulants
3) Removal techniques
4) Operation and Maintenance procedures

EPA and OSHA Regulations Related to Asbestos

Both EPA and the Occupational Safety and Health Administration (OSHA) have published regulations to reduce exposure to asbestos. The EPA TSCA rules have focused on two aspects of asbestos in buildings; (1) the application of asbestos-containing materials in new or remodeled buildings, and (2) the identification of friable* asbestos in schools. In addition to these rules, EPA has regulated the emission of asbestos fibers from the handling of asbestos in asbestos industries and the disposal of asbestos-containing waste. The OSHA regulations address worker protection in asbestos workplaces. EPA has issued two sets of regulations. The first set was promulgated under the National Emission Standards for Hazardous Air Pollutants (NESHAPS) as authorized in the Clean Air Act. This set of regulations includes a 1973 ban on the use of spray-applied asbestos-containing materials in buildings for insulating or fireproofing purposes, except for equipment and machinery, as well as the specification of "no visible emissions" from permitted spraying, as published in the FEDERAL REGISTER (38 FR 8826). Methods of removing friable asbestos from buildings during demolition also were regulated at this time. The ban was amended in 1975 to include molded and wet-applied insulation, as published in the FEDERAL REGISTER (40 FR 48292). In addition, rules governing asbestos removal were broadened to include building renovation, and procedures for disposal of removed materials were defined. Finally, the ban on spraying asbestos-containing materials was broadened in 1978 to include decorative applications, but also was clarified

* Friable material is defined as being capable of reduction to powder under hand pressure.

to exclude all applications covered with a particular type of nonfriable material, as published in the FEDERAL REGISTER (43 FR 26372). In addition to these regulations, emission standards have been promulgated under NESHAPS for asbestos mills, asbestos manufacturing facilities, and asbestos fabrication plants (See 40 CFR, Part 61, Sections A and B for a compilation of all asbestos regulations issued under NESHAPS.)

The second set of EPA regulations is contained in the "Friable Asbestos-Containing Materials in Schools, Identification and Notification Rule," as published in the FEDERAL REGISTER (47 FR 23360). Known as the "Asbestos-in-Schools Rule," it requires all private and public primary and secondary schools to inspect, sample, and analyze friable materials to determine if asbestos is present. If friable asbestos is present, all school employees must be informed of the location of these materials and each custodial or maintenance employee must be provided a copy of the EPA publication, "A Guide for Reducing Asbestos Exposure," as published in the FEDERAL REGISTER (47 FR 23360). In addition, the school's parent-teacher group (or parents, if there is no organized group) must be notified of the presence of friable asbestos.

The OSHA regulations were first issued in 1972 and modified in 1976. (See 29 CFR, Part 1910 for the complete text.) They specify airborne exposure standards for asbestos workers, engineering and administrative controls, workplace practices, and medical surveillance and worker protection requirements. In 1982, OSHA announced its intention to make the exposure standards more stringent. (See the "Calendar of Federal Regulations," published in the FEDERAL REGISTER [47 FR 1807].) The OSHA regulations apply to all workplace activities involving asbestos, including removal of asbestos-containing materials from buildings.

Although the NESHAPS and OSHA regulations include standards to reduce exposure to airborne asbestos, the standards were designed primarily to protect the health of people living near asbestos plants, working in the asbestos industry, or removing asbestos from buildings. Exposure to asbestos by persons occupying buildings with asbestos-containing materials is not addressed directly by the standards. Specifically, EPA's NESHAPS for asbestos are directed only at emissions into the outside air (no "visible emissions" resulting from asbestos-handling operations) and do not apply to indoor levels. OSHA provides specific worker exposure standards, but the application of these standards to nonindustrial settings is inappropriate for two reasons. First, the current standards were set to protect workers against only asbestosis, not cancer. Second, the measurement technique for airborne fibers required to determine OSHA compliance cannot distinguish between asbestos and nonasbestos fibers. The measurement problem is not a major shortcoming in industrial settings where most airborne fibers are expected to be asbestos. However, airborne asbestos may represent only a small fraction of all fibers in the air in buildings, and the OSHA measurement technique may produce misleading conclusions. (Other limitations of the OSHA technique further confound the measurement of airborne asbestos in buildings.)

The Asbestos Hazard Emergency Response Act of 1986 required EPA to issue the Asbesto-Containing Materials in Schools Final Rule and Notice (40 CFR Part 763) in October 1987. This rule includes practically all of recommended practices contained in the guidance documents which EPA published in 1979, 1983, and 1985 and added specific requirements of the AHERA such as required

training courses for all phases of asbestos abatement from inspection and planning to actual removal. Before an abatement action can be ruled complete, the rule requires the results of air sampling analyses to be acceptable, then the abatement area can be reoccupied. The Transmission Electron Microscope must be used (by a certified analyst) to perform "clearance" air sample analyses on all but the smallest jobs as limited by the rule.

Why are Congress and EPA concerned about the relatively small amounts of airborne asbestos usually found in schools? There are the medical research findings that breathing airborne asbestos fibers can cause asbestosis, lung cancer, mesothelioma, and other organ cancers. At this point in time there is no established threshold concentration of asbestos below which no health effects are found. Once inhaled deep into the lungs and trapped by body fluids on the surface of the lung, the asbestos fibers remain until either they are dissolved by the body fluids, or in the case of crocidolite and amosite, for life. Latency periods can be from about 10 to 50 or more years between exposure and evidence of disease (usually 15 to 40 years).

Airborne asbestos concentrations measured by EPA indicate that concentrations inside buildings where asbestos is present are generally very low and near ambient outdoor levels (approximately .005 asbestos fibers/cc). The fibers are usually very small - ranging from about 0.3 to 3 um in length. Where the asbestos-containing material in the building is being disturbed, the concentrations can be raised thousands of times the normal level at the disturbance point. Common heating ventilation and air conditioning (HVAC) systems help to spread the airborne asbestos fibers throughout the building. Unless some long-term project is ongoing which causes continual disturbance of the ACM, the duration of relatively "high level" of exposure is usually brief. Thus it is the long-term exposure to the "constant" low levels of airborne asbestos fibers that constitute (along with occasional short episodes of high concentrations) the major part of the hazard to which we are all exposed.

Schools where young children must spend six or more hours a day for much of 12 years can be the source of exposure to many fiber years dosage at a time in their physical development before the clearance mechanism of the respiratory system is completely developed. Children's lungs therefore retain a larger percentage of inhaled fibers. Add the latency period to the school age and it is likely that any lung cancer or mesothelioma which results from asbestos exposure in schools will occur at a relatively young age. Asbestosis is not usually a problem at low concentration exposure.

These risk factors caused Congress to require that EPA promulgate the AHERA rule as a first step in regulating asbestos in buildings. The main requirements of the AHERA rule are intended to assure that all phases of any asbestos related work in schools from inspection to removal are handled by trained people certified as competent by State agencies for the type of work they are doing. EPA developed model training criteria for the States to use in developing their training requirements. Some states were requiring training and licensing of asbestos abatement contractors prior to the issuance of the AHERA rule both for school work and other building abatements.

Because of many factors, ACM is often left in place in buildings for many years or until the building is demolished for replacement. In schools it is required under the AHERA rule, and EPA recommends that the practice be

implemented in all such cases in other buildings, that an operations and maintenance (O&M) program consisting of identifying all ACM in the building, notifying occupants of the locations and warning all that there is to be no disturbance of the ACM except by trained personnel using the proper equipment and practices. All custodial and maintenance workers are instructed in the proper cleaning and maintenance procedures and provided with proper equipment. Visible ACM debris is wetted and cleaned up as soon as possible. Periodic inspections are required to maintain up-to-date records of the condition of all ACM. Repairs are done as soon as possible after damage is found, and are done only by trained personnel using proper techniques and equipment. By maintaining a close watch on all ACM in the building and keeping it in good repair, and using proper cleaning and maintenance equipment and techniques, it is likely that airborne asbestos concentrations will be minimized.

EPA is conducting research of the effectiveness of various O&M practices in maintaining low airborne asbestos fiber concentrations and in reducing the potential for episodes of high fiber release. One such project is looking at carpet cleaning using High Efficiency Particulate Air (HEPA) filtered vacuum cleaners, and at "steam cleaning" with standard building maintenance equipment made for that purpose. Another project is sampling the exhaust of HEPA filters in negative air units at several abatement sites to measure any asbestos content.

Asbestos Abatement

Due perhaps to early publicity on the potential hazards of inhaling asbestos, many building owners rushed to remove all ACM from their buildings believing that this would somehow relieve them of liability or responsibility for exposure of occupants to airborne asbestos. The removals were often done by contractors and workers with no training in dealing with ACM. Such practices were unfortunate. Even when contractors and workers are knowledgeable about the hazards and correct methods for protecting themselves and others from the exposure to them, they don't always follow the rules. The invisible nature of the fibers plus the long latency period for adverse health effects to develop seems to lead to a "it probably won't make any difference" attitude. The outcome of asbestos litigation indicates that juries take this negligence seriously.

There are still many things we don't know about the health effects of low level (ambient to say 30 x ambient) exposure to airborne asbestos fibers and about the best way to handle asbestos abatement in buildings. We are learning from experience that it is best to act deliberately and cautiously in carefully inspecting, planning, and executing any abatement job. Only unrepairable, deteriorating ACM with visible release of material may need to be removed at once. Each building is a new problem and O&M and abatement must be tailored to fit the circumstances.

The American Society for Testing and Materials (ASTM) has recognized the need for standards for inspection, electron microscope analysis of air samples, and bulk sample analysis of ACM and has such standards in process.

The USEPA will continue to study means for controlling airborne asbestos in buildings and will modify guidance and rules to reflect any improved methods which are developed.

Many questions have risen as more people try to deal with asbestos problems in buildings. It is not always clear how EPA guidance and Rules apply to specific instances. Encapsulation seems to be one subject which generates a great amount of confusion. Part of the confusion is due to an earlier research project evaluating about 150 candidate encapsulants submitted by manufacturers who perhaps saw this field as having future sales potential. A set of criteria was developed against which the candidate encapsulants were compared. Eleven met all the criteria and about twenty others were close enough to be satisfactory. This list was disseminated on demand and became the "EPA approved list," even though EPA repeatedly denied such status. Those manufacturers on the list did not discourage it's use.

Since then many newer and improved encapsulants entering the market were resisted because they weren't on "the list". Also many contractors, and consultants only recommend using these encapsulants as a "lock down" application after a removal to hold in place small bits of ACM which stubbornly resisted removal. This is a very good use for encapsulants, but should not be the only use.

Common sense should tell us that applying an encapsulant over ACM which has previously been painted, or which has been water damaged, or which is falling from its own dry weight before it is wetted with an encapsulant should not be done. Only ACM strong enough to be wetted and stay in place, previously unpainted, and not water damaged should be considered for encapsulation. If the ACM is in a location subject to frequent disturbance or maintenance or in a building nearing the end of its useful life, it should not be encapsulated. Remember that the NESHAPS requires removal of ACM from buildings prior to demolition, and well encapsulated ACM can be very difficult to remove.

EPA is now facing the problem basic to the asbestos abatement business. By definition, any material containing more than one percent asbestos is considered hazardous under EPA rules. Many installations of low asbestos content materials are at question. Before spending large amounts of money on abatements, building owners want to know exactly what percentage of asbestos the material in question contains. The polarized light microscopic (PLM) method used can give a wide range of results for the same material mix. Resolution of this problem may require some different method of analysis than presently used, at least in the very low (around one percent) asbestos content mixes.

Another area which has raised questions is the use of wetting agents. Chrysotile asbestos has an opposite surface charge polarity from amosite asbestos. Consequently the anionic surfactant which is added to the water used to wet and loosen chrysotile asbestos doesn't wet amosite asbestos. Where both chrysotile and amosite are in the mix, perhaps both anionic and cationic surfactants are needed.

Small asbestos removal jobs can become very costly if subjected to the same control and clearance sample requirements as the AHERA Rule applies to large jobs. Exceptions are made in the rule allowing small abatements to be cleared by visual inspection and Phase Contrast Light Microscope analyses of air samples.

Glove bags have been widely used to effect small repairs on pipes and fittings insulated with asbestos-containing material. Research has shown that, even when used carefully, glove bags are not 100% effective in containing airborne asbestos. The normal situation is often that the user is not well trained and the techniques used may result in large amounts of airborne asbestos releases. Since the glove bags are often the only containment for the abatement, and workers often don't use respirators, the result is exposure to airborne asbestos for both the abatement worker and future occupants of the area. NIOSH, in an interagency agreement with EPA, is currently studying the use of glove bags incorporating a wire frame to prevent collapse and a HEPA filtered vaccuum to keep the glove bag under negative pressure while in use. In theory at least, this should greatly reduce the amount of airborne asbestos released from glove bag use.